OIL AND GAS POTENTIAL

OF THE

FOUR RIVERS FIELD OFFICE

IDAHO

Prepared by: Karen Porter, BLM Idaho State Office Geologist

Prepared by: /s/ Karen Porter Date: 10/16/2009

SUMMARY

Overall the lands within the Four Rivers Field Office (i.e., the planning area) have no or low potential for the discovery and/or development of an oil or gas resource, with the exception of the area generally west of Caldwell and Emmett, and south of Weiser (see map, figure 1), which is determined to have moderate potential for natural gas. This determination is based on the geology of the area, historic drilling, current drilling proposed on private lands, and overlapping lease nominations that are currently pending completion of this planning effort.

PURPOSE

The purpose of this report is to describe the potential for occurrence of oil and gas resources in the planning area, in support of the Four Rivers Resource Management Plan (RMP) revision. According to BLM policy, the issuance of oil and gas leases under the Federal Onshore Oil and Gas Leasing Reform Act of 1987 is only allowed in areas where sufficient NEPA analysis has been conducted and Supplemental Program Guidance (SPG) requirements (BLM Handbook 1624-1, Planning for Fluid Mineral Resources) have been met. Based on the level of oil and gas potential, cumulative impacts of reasonably foreseeable oil and gas activity can be estimated and addressed in the Environmental Impact Statement (EIS) written for the RMP, as required by the SPG. This report and the accompanying Reasonably Foreseeable Development Scenario (RFDS) will provide information necessary to analyze oil and gas leasing and to develop leasing stipulations, by assuring that the RMP complies with NEPA and Bureau requirements.

BACKGROUND

Oil and gas potential can be qualitatively judged on the basis of the presence or absence of basic geologic criteria including: a source rock formation, a reservoir rock formation, a trap rock formation, and thermal maturation (McLeod, 1993).

Source rocks, such as shales or other fine-grained sedimentary rocks, typically of marine origin, preserve organic matter from destruction in an anaerobic (oxygen-free) environment. Heat and pressure transform this organic matter into hydrocarbon molecules, creating mostly liquids at first, then gas as temperature and pressure increase. Permeability, the capacity of a medium to transmit fluids, allows disseminated liquid or gaseous hydrocarbons, which are less dense than water, to move through the rock. Porosity makes the space for oil or gas to pool in an underground reservoir. A seal, created over the reservoir by an impermeable caprock, blocks the upward leakage of hydrocarbons and the downward infiltration of fresh water from the earth's surface. A trap is formed by an anticline, fault, pinchout, unconformity, or other geologic feature that, in concert with a seal, prevents lateral and vertical leakage. Even when all conditions are present and oil or gas is discovered, the deposit must be large enough to justify the expense of developing it.

According to the SPG, oil and gas potential is classified in the following manner:

High Potential: Inclusion in an oil and gas play (presumed to be proven vs. hypothetical) as defined by the USGS national assessment or, in the absence of a play designation by USGS, the demonstrated existence of: source rock, thermal maturation, and reservoir strata possessing permeability and/or porosity, and traps. Demonstrated existence is defined by physical evidence or documentation in the literature.

Medium Potential: Geophysical or geological indications that the following may be present: source rock, thermal maturation, and reservoir strata possessing permeability and/or porosity, and traps. Geologic indication is defined by geological inference based on indirect evidence.

Low Potential: Specific indications that one or more of the following may not be present: source rock, thermal maturation, and reservoir strata possessing permeability and/or porosity, and traps.

No Potential: Demonstrated absence of (1) source rock, (2) thermal maturation, or (3) reservoir rock that precludes the occurrence of oil and/or gas. Demonstrated absence is defined by physical evidence or documentation in the literature.

DESCRIPTION OF GEOLOGY

The planning area lies within three geologic provinces- the Idaho Batholith, the Weiser embayment of the Columbia Plateau, and the western Snake River Plain. The Idaho Batholith lies north of the Treasure Valley and east of the Payette River, and is comprised of granitic rock with no oil and gas potential due to the lack of a source rock. The Weiser Embayment, which lies north of Weiser and Payette, and west of the Payette River, is comprised of thick sequences of Columbia River basalts with no to low oil or gas potential, due to depth of any source rock that may underlie the basalts.

The remaining parts of the planning area lie within the western Snake River Plain, an approximately 40-mile wide, northwest-trending graben structure, filled with sediments of Plio-Pleistocene Lakes Idaho and Bruneau and intercalated basalts. These sediments are referred to as the Idaho Group (Pliocene) and Payette Formation (Miocene), and are very similar in that they consist of semi-consolidated clay, silt, sand, volcanic ash, diatomite, freshwater limestone, conglomerate, and intercalated basalt flows. This is the only region in the planning area with any oil and gas potential.

While there is no type section of the Payette formation, it is described as a thick body of fresh-water and continental sediments, generally made up of ash, clay, shale, and sandstone, with an occasional lignite bed (Buwalda, 1923). The sediments are known to contain organic material, including petrified tree stumps, fresh-water shells and mammalian fossils, such as ancestral horses and camels. Strata seen at Payette extend westward across the Snake River for long distances into Oregon. The Payette formation has been measured at over 4000 feet in a deep well at Ontario, Oregon.

The Payette Formation has been gently folded, but the folds are irregular, do not parallel each other and usually cannot be followed for great distances. Subsurface data indicate abrupt lateral variations in the section and low to moderate porosity and permeability in some of the sands (Deacon and Benson, 1970). Gravity anomalies suggest the presence of numerous structural blocks, which are late Tertiary normal-fault patterns.

The Idaho formation is younger than the Payette and lies east of the Boise area. Both the Payette and Idaho formations locally contain swamp and lake deposits including beds of vegetation in various stages of decomposition, which yield methane gas. The gas found in the water wells of the SRP almost certainly originates in these deposits (Youngquist and Kiilsgaard, 1950).

McLeod (1993) states that deep seismic exploration profiles show large fault blocks that could create traps on the western Snake River Plain. Potential porous reservoir rocks are interbedded with clay that could form seals; and natural gas shows are common in deeper parts of the basin. The scarcity of thick, organic-rich source beds, however, as well as the possibly destructive effects of past high temperatures (volcanism) may explain why no commercial production has occurred. It may be possible that deeper, older sedimentary formations, not yet penetrated by drilling, may someday yield commercial quantities. Based on current data, however, this is very speculative.

PAST AND PRESENT OIL AND GAS LEASING ACTIVITY

BLM records indicate that there have been a total of approximately 5,800 Federal oil and gas leases in Idaho, and that 431 of those leases have been issued in the past in the planning area (7.5% of the total). These leases were issued under a non-competitive leasing system until 1987, when FOOGLRA (Federal Onshore Oil and Gas Leasing Reform Act) was passed. This amendment to the Mineral Leasing Act requires that parcels be offered, at least initially, for competitive bidding. The last leases to be issued in the planning area expired in 1995 (leases are issued for an initial 10 year term).

There are currently no active leases in the planning area, however in 2006 approximately 181,000 acres were nominated for oil and gas leasing by two entities. These parcels are located on BLM and split estate lands in portions of Payette County, western Gem County, and northern Canyon County (**see Map of Lease Nominations, Figure 2**). Some of the nominated parcels overlap with each other (the parties nominated some of the same lands). A leasing decision is being deferred on these parcels pending completion of the RMP/EIS.

Until 2006, the State of Idaho (Idaho Department of Lands) had very few oil and gas leases on private and state lands, due to a lack of industry interest. Since that time, however, the state has held 5 oral auctions and has issued approximately 120 oil and gas leases in the planning area (out of 174 leases total). These leases are located in Canyon County (52), Payette County (35), Gem County (22), and Washington County (11) (Wilson, personal communication).

PAST AND PRESENT OIL AND GAS EXPLORATION ACTIVITY

Despite the drilling of over 150 exploration wells in the state of Idaho, not a single well has encountered commercial quantities of oil or gas. That said, the western Snake River Plain, especially the Payette- New Plymouth area, is considered the second most promising area in the state (behind the Overthrust Belt in southeast Idaho), primarily because of the minor amounts of natural gas encountered during drilling for water wells. The first exploratory oil and gas well in the planning area is reported to have been drilled in 1907 in the Payette area (Breckenridge et. al., 2006). When natural gas was reported from this well, it created a flurry of exploration activity and excitement in the Payette area, but as more wells were drilled and no oil was found, interest quickly waned. Exploration drilling continued sporadically (depending on economic conditions) throughout the 20th century- a total of 57 wells have been reportedly drilled in the planning area. Of these, 13 wells encountered gas (methane), albeit not in commercial quantities. These gas wells were located primarily in the Payette-New Plymouth area, although a few wells with gas shows are scattered throughout Canyon County (BLM, 1984). The deepest well (a dry hole) in the planning area was drilled in 1976, to a depth of 14,006 feet (located north of the town of Meridian in T. 4 N., R. 1 W., section 27). The deepest well with a gas show was drilled in 1981 to a depth of 9022 feet (located south of Lake Lowell in T. 2 N., R. 2 W., section 19).

Deacon and Benson (1970) report that the Oroco Oil and Gas Co. No. 1 Richardson well (located in T. 4 N., R 3 W., section 19) was drilled to a depth of 3048 feet and flowed 50 Mcf/day of gas on production tests. Several other wells had flows estimated as 50 to 350 Mcf/day on the basis of formation tests (1Mcf equals 1000 cf, which is enough gas to heat four homes per day). Most of the gas samples analyzed were more than 90% methane, although heavier fractions were noted from at least one well. Results indicate low-volume reservoirs. In all cases, methane gas emissions were short-lived (Newton & Corcoran 1963).

No drilling has occurred in the planning area since 1984, however in August of 2009, Bridge Resources Corporation, out of Calgary, Alberta, announced plans to drill 4 exploratory wells to 4500 to 7000 feet in southwest Idaho at a cost of $4 million (Oil and Gas Journal, 2009; paramaxresources.com, 2009). The Idaho Statesman reports in a September 13, 2009 article, that two of the wells are to be located east and southwest of New Plymouth, and two wells are planned for the Willow Creek drainage northeast of Payette. No Federally administered lands are involved in this drilling project, however there are BLM administered lands in the Willow Creek area and south of New Plymouth. No drilling or geophysical surveys are currently proposed on BLM- administered lands for oil and gas (however a geothermal lessee is currently drilling 7 temperature gradient wells on public lands in the Crane Creek area).

The remaining area of the western Snake River Plain (east of Caldwell and Emmett) has experienced some exploratory drilling, with no success at finding oil or gas. Near Hammett, three wells were drilled in the Sailor Creek-Indian Cove area, where considerable gas had previously been encountered in water wells (Youngquist and Kiilsgaard, 1951). None of the exploratory wells drilled encountered oil or gas.

PAST AND PRESENT OIL AND GAS DEVELOPMENT ACTIVITY

To date, there has never been any oil or commercial gas production in Idaho, despite the drilling of approximately 150 wells in the state (Breckenridge et. al., 2006). In some locations of the planning area, primarily in northwestern Payette County, historic drilling encountered small quantities of natural gas, specifically methane. While Hart (2009) reported that a natural gas pipeline was planned after the first well was drilled in 1907, the only reported use of the gas resource was for heating and lighting (of single buildings) in the early 20th century in a few instances in the Weiser and Payette areas.

OIL AND GAS OCCURRENCE POTENTIAL

Idaho Batholith- Zero potential.

The widespread presence of granitic rocks of the batholith rules out the presence of a source rock in this area.

Columbia Plateau- Zero to low potential.

This region, known as the Weiser Embayment, is associated with a thick cover of the Miocene Columbia River Basalt. The Columbia Plateau is largely unexplored and the subsurface largely unknown because of the vast volcanic cover. Conventional geophysical techniques have been unable to penetrate the basalts.

In the western part of the area along the Snake River, a variety of Pre-Tertiary rocks crop out discontinuously through the basalt. These Pre-Tertiary rocks consist mostly of a wide range of late Paleozoic through Triassic volcaniclastic sedimentary, metasedimentary, and metavolcanic rocks. Although some of the marine sedimentary rocks may have some minor potential, the high degree of metamorphism of many of these rocks indicates a poor chance for accumulation of petroleum resources.

Although the basalts probably overlap plutonic rocks to the east and Pre-Tertiary metamorphic rocks to the west, accumulations of non-marine carbonaceous sedimentary rocks may underlie central parts of this area within the planning area. Therefore some minor potential cannot be ruled out.

Western Snake River Plain- Generally low potential for petroleum (natural gas) resources, however a medium potential has been assigned to the area generally west of Caldwell and Emmett, and south of Weiser (see Oil and Gas Potential Map, Figure 1).

The best potential for petroleum resources in the planning area is within the western Snake River Plain, particularly the lands mentioned above. The petroleum potential of this area is difficult to assess because of the persistent of intercalated volcanic beds, the relatively low density of exploratory drilling, and a paucity of subsurface geophysical data. However, numerous gas shows from exploratory wells on the Snake River Plain, particularly in the Payette-New Plymouth area, indicate the presence of at least some minor accumulations of methane and related gases in isolated pockets. Methane associated with ground water systems has also been reported from many water wells throughout the western SRP. The presence of larger commercial accumulations of gas is presently unknown. Thick sequences of carbonaceous lacustrine sedimentary rocks intercalated with volcanic sequences have some potential as source and trap rocks. While the formations are only slightly folded, numerous normal faults within the sediments may trap pockets of hydrocarbons in localized areas. Recent interest in the area, as evidenced by the large number of state leases that have recently been issued, nominations received for federal leases, and recently announced plans to conduct drilling on private lands, supports this conclusion.

Conclusion

The overall probability of discovering and developing a producing oil and/or gas field in the planning area is considered to be low, with the exception of the general area east of Caldwell and Emmett, south of Weiser, where the potential for discovery of gas in particular, is determined to be moderate. This rating is based on the following factors:

1) The geology of the planning area indicates some potential in the western Snake River Plain. Lacustrine sediments with some organic materials are present as source rocks. While the sediments are not strongly folded, normal faults within the sediments abound in the basin.

2) No wells capable of commercial production have ever been drilled, despite the drilling of 56 exploratory wells in the planning area. 13 wells, located primarily in the Payette- New Plymouth area, did encounter gas for a short time. No exploration drilling has been conducted in the planning area since 1984.

3) There are no demonstrated oil or gas reserves in the planning area or adjacent areas.

4) Between 1985 and 2006, no BLM-administered lands in southwest Idaho were nominated for competitive leasing. In 2006 approximately 181,000 acres were nominated for leasing. The state of Idaho has issued 120 leases since 2006.

5) An exploration company recently announced plans to drill four wells on private and state lands in the Payette-New Plymouth area.

LITERATURE CITED

BLM, Steve Moore (1984). *Petroleum and Geothermal Potential* (Appendix W of Cascade RMP). USDOI Bureau of Land Management.

Breckenridge, R. M., Gillerman, V. S., & Wray-Macomb, E. (2006). *Oil and gas exploration in Idaho* (Digital Web Map 81). Moscow, ID: Idaho Geological Survey.

Buwalda, John P., 1923. *A preliminary reconnaissance of the gas and oil possibilities of southwestern and south-central Idaho.* Idaho Geological Survey, Pamphlet No. 5.

Deacon, R.J. and Benson, G.T., 1970. *Oil and Gas Potential of Eastern Oregon and Washington and Snake River Basin of Western Idaho.* American Association of Petroleum Geologists Memoir 15, v. 1, 1971.

Energy Information Administration (EIA) website (available at http://www.eia.doe.gov/pub/oil_gas/natural_gas/analysis_publications/ngpipeline/western...) accessed 9/10/2009.

Hart, Arthur, *"Fruit trees, oil rigs brought Payette into 20th century"*, Idaho Statesman, May 3, 2009.

McLeod, John D., undated. *The search for oil and gas in Idaho.* Idaho Geological Survey GeoNote 21.

Peterson, J. A. (1995). *Idaho-Snake River Downwarp Province (017)*. USGS National Oil and Gas Assessment, USGS Digital Data Series DDS-30, Release 2 (available at http://certmapper.cr.usgs.gov/data/noga95/prov17/text/prov17.pdf).

Wilson, Eric (Idaho Department of Lands). Personal communication with Porter on October 14, 2009.

Wood, Spencer H. (1994). *Seismic expression and geological significance of a lacustrine delta in Neogene deposits of the western Snake River Plain, Idaho.* Bulletin of the American Association of Petroleum Geologists, 78 (1), 102-121.

Youngquist, W., & Kiilsgaard, T. H. (1951). *Recent test drilling, Snake River Plains, Southwestern Idaho.* Bulletin of the American Association of Petroleum Geologists, 35(1), 90-96.

Figure 1

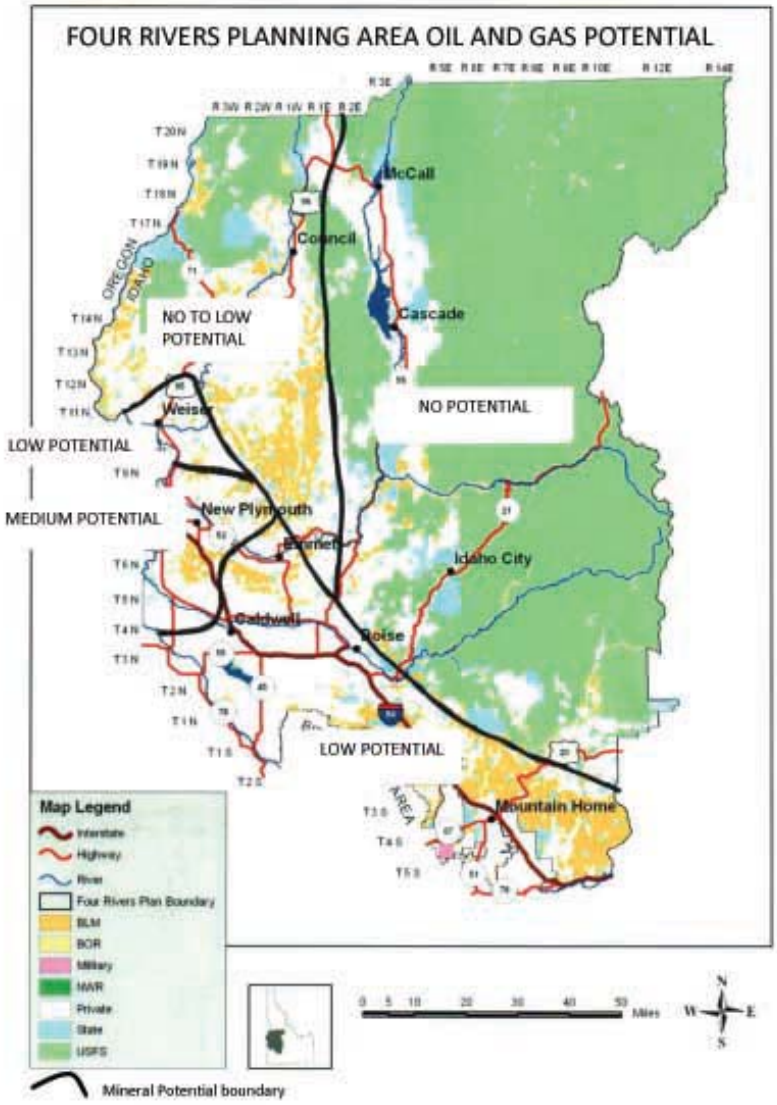
FOUR RIVERS PLANNING AREA OIL AND GAS POTENTIAL
McCall
Council
Cascade
NO TO LOW POTENTIAL
NO POTENTIAL
Weiser
LOW POTENTIAL
MEDIUM POTENTIAL
New Plymouth
Idaho City
Caldwell
Boise
LOW POTENTIAL
Mountain Home
Map Legend
Interstate
Highway
River
Four Rivers Plan Boundary
BLM
BOR
Military
NWR
Private
State
USFS
Mineral Potential boundary
Miles
N
W
E
S

FIGURE 2-
FOUR RIVERS PLANNING AREA OIL AND GAS LEASE NOMINATIONS